# CS465 Lockpicking UI

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User Interactions in Virtual Reality have been studied in tasks, our group wanted to make it something more interesting and give the user something new to learn to use ethically later when needed. We want to teach people how to lock pick using an MX Ink pen and an Oculus 3 to compare the difference between the pen and the controllers for precise movements. Through a game and walking the users through how to use the controllers and the pen for the task, we will time them to see which is more precise for the task. We think the pen will be better for those precise movements.

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## 1 Introduction

Lock picking has become a topic of increasing interest in recent research, particularly in the context of teaching it through Virtual Reality (VR). The rise of consumer-grade VR devices, such as the Oculus Rift, HTC Vive, and Gear VR, has introduced innovative ways for users to interact with digital environments. In general, VR extends the user-interaction paradigm of traditional graphical user interfaces [4]. This extension provides a platform for exploring educational experiences that would otherwise be difficult or unsafe to conduct in real life.

VR-based lock picking simulations offer a unique opportunity to visualize the internal mechanics of a lock. Users can observe the pins, barrel, and the process of applying pressure to align the pins correctly to unlock the mechanism, much like using a real key. Unlike physical training locks that are transparent, VR allows for an unobstructed and interactive view. This immersive environment makes it easier for users to understand the intricate mechanics involved in lock picking, enhancing both comprehension and retention.

Our research also focuses on making the experience enjoyable and game-like, rather than feeling like a formal experiment. Learning new skills can be engaging when presented interactively and playfully. Isomorphic interaction modes, which closely mimic real-world movements, have been shown to improve performance in VR tasks [5]. These modes reduce the learning curve for users unfamiliar with VR, making actions like turning or lifting more intuitive.

In our application, we propose using a VR pen-like tool to simulate the lock pick. Previous studies indicate that users are more familiar with using VR controllers in a power grip rather than a precision grip, which is less ideal for detailed tasks such as pin manipulation [6]. By incorporating a pen interface, we enable more precise

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movements, allowing users to lift pins with greater accuracy. This approach not only enhances realism but also aligns with the goals of effective skill transfer and user engagement.

## 2 Related Works

In our case, we are looking at different input devices in a Virtual environment. Other studies have found that a VR is effective in training and can improve presence in a training scenario, this will be similar to our case; however, we are in lock picking compared to the aviation environment from this study[1]. This first related study lacked in the controller inputs, mainly relying on unimodal control with an Xbox controller. However, the main takeaway that benefited us was the psychological effects of the VR environment that enchanted the feeling in training and had more of an impact. We look to enhance this experience from this study using other controller types. In a study that explored the best controller types in a VR environment, the study used the VR environment with a ball sorting task and compared hand tracking vs regular controller types.

It was found that hand tracking was less preferred than the controller, and seeing hands did help in results [2]. This work is useful in determining our focus in our case. Previous related works show that hand-tracking is less preferred, so we can narrow our focus to focus on a controller and a pen with our hypothesis. In another study, it explored controller type on the experience of users in a video game [3]. It found that users felt more natural with the Oculus Touch controller compared to the Xbox controller [3]. This helps in answering the controller type for inputs. This shows the importance our the related works to help us in our case. We have a basis for what we are looking to accomplish and how we differ from the related works.

We are motivated by these related works and it helps in our case to improve our case by introducing the pen to see the effect of that in our case. In our case, we have the pen to test different inputs; the difference in grips involves different muscle groups, which potentially results in different pointing performances when it comes to using the pen [1]. Using the different muscle groups is something to keep in mind so we do not cause fatigue in the participants and to make the tasks not too difficult for those who might not be able to use some muscle groups. The pen can be used as a controller, which makes it easier to use for ergonomics, control of the amount of pressure, and hand poses that can be used on a pan that is not as easy with a controller, can cause differences in performance [1]. For this experiment it would be useful to use this as both a controller and a pen to get the precision we need and to also facilitate the same way of holding tools for lock picking. The difference between the two input devices is something our experiment wants to figure out.

There have been many approaches that are similar to ours, and we look to accomplish a mission that takes these related works and elevates them to add another layer to them. The different controller types and knowing a little bit about them and their users helps find the most efficient one. [3]. We know how they feel in a virtual environment in a training environment and we can use that to help our case.

## 3 Methodology

### 3.1 Participants

The study recruited a sample of 10 to 30 participants, all complete beginners with no prior lock picking experience. Participants were selected based on specific demographic criteria, including age range and diversity, to ensure a balanced representation. The primary objective of the research was to compare the effectiveness of learning basic lock picking techniques in a virtual reality (VR) setting using a standard VR controller or a pen stylus. To achieve this, participants were randomly assigned to one of two groups. Group 1 will use the standard VR controller, while Group 2 will use the pen stylus. The VR environment was accessed via a Quest 3 headset and utilized a custom-built lock picking simulation or an adapted VR application.

### 3.2 Study Design

The study procedure began with a pre-test phase, during which participants were briefed about the study details, the experimental setup, and the VR interface. Informed consent was obtained from all participants following this introduction. They then participated in a training phase, spending between 30 and 60 minutes in the virtual environment practicing lock picking techniques with their assigned tools. Training was followed by a testing phase in which participants were challenged to open locks of varying difficulty within predetermined time limits.

### 3.3 Measurements

Quantitative data was collected based on measures such as the time taken to pick each lock and the number of successful attempts. In parallel, qualitative data were collected through participant feedback on ease of use, realism of the simulation, and overall tool preference. The analysis of quantitative results was performed using statistical methods like t-tests or ANOVA, while a thematic analysis of participant feedback identified consistent patterns and insights regarding user experience. Throughout the study, ethical considerations were rigorously maintained: informed consent was mandatory, participants retained the right to withdraw at any stage, and strict confidentiality was ensured during data collection and reporting. Finally, the study acknowledges limitations, including the small sample size and limited generalization due to the use of simulated locks rather than actual physical lock picking scenarios.

Expanding on these details might lead to further discussion on potential future applications of VR in skill acquisition, as well as exploring alternative quantitative metrics and qualitative insights that could deepen our understanding of human-tool interactions in simulated environments.

## 4 Limitations

We hit a few limitations when it came to the experiment of only being able to do one person at a time, because it took longer to get the data. The amount of time to do this project was only a semester long, making it not as in-depth as we would like to go into this or to make a game that is in-depth about locks to get all the workings, or to go more into complex locks.

## 5 Conclusion

This is where we will put our conclusion from the experiments and all we have learned about which is more precise of the MX Ink pen or the Quest 3 controllers.

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